

What is claimed is:

1           1. A method for detecting shadow regions in an image, the  
2 steps comprising:

3                 a) providing an original image;

4                 b) modeling said image as a reliable lattice (RL);

5                 c) determining a relationship between said RL model  
6 and an Markov (MRF) model;

7                 d) applying region level verification to said MRF  
8 model; and

9                 e) identifying shadow regions in said original image  
10 from said MRF model.

1           2. The method for detecting shadow regions in an image as  
2 recited in claim 1, wherein said original image is a single,  
3 static image.

1           3. The method for detecting shadow regions in an image as  
2 recited in claim 2, wherein said single, static image is  
3 illuminated by substantially a single point illumination  
4 source.

1           4. The method for detecting shadow regions in an image as  
2       recited in claim 2, wherein said single point illumination  
3       source is the sun.

1           5. The method for detecting shadow regions in an image as  
2       recited in claim 2, wherein said single, static image  
3       comprises an aerial image.

1           6. The method for detecting shadow regions in an image as  
2       recited in claim 1, wherein said modeling said image as an RL  
3       step (b) comprises the sub-step of modeling an initial RL.

1           7. The method for detecting shadow regions in an image as  
2       recited in claim 6, wherein said modeling said image as an RL  
3       step (b) further comprises the sub-step of updating said  
4       initial RL.

1           8. The method for detecting shadow regions in an image as  
2       recited in claim 7, wherein said sub-step of updating said  
3       initial RL comprises iteratively updating said initial RL.

1           9. The method for detecting shadow regions in an image as  
2       recited in claim 8, wherein said sub-step of iteratively  
3       updating said initial RL continues until at least one of the  
4       conditions have been met: a predetermined number of iterations  
5       are performed, and until a predetermined condition is met.

1           10. The method for detecting shadow regions in an image  
2           as recited in claim 1, wherein said modeling said image as an  
3           RL step (b) comprises the sub-step of determining the  
4           reliability of said RL.

1           11. The method for detecting shadow regions in an image  
2           as recited in claim 10, wherein said sub-step of determining  
3           the reliability of said RL comprises determining a maximum  
4           reliability of said RL.

1           12. The method for detecting shadow regions in an image  
2           as recited in claim 10, wherein said sub-step of determining a  
3           maximum reliability of said RL comprises using an expectation  
4           maximization (EM) algorithm.

1           13. The method for detecting shadow regions in an image  
2           as recited in claim 1, the steps further comprising:

3                   f) removing at least one false shadow region from a  
4           list of detected shadow regions.

1           14. The method for detecting shadow regions in an image  
2 as recited in claim 1, the steps further comprising:

3           f) preprocessing said original image from an a  
4 red/green/blue RGB) color space into a normalized LogRGB  
5 space.

1           15. The method for detecting shadow regions in an image  
2 as recited in claim 1, the steps further comprising:

3           f) performing region level verification.

1           16. The method for detecting shadow regions in an image  
2 as recited in claim 15, wherein said performing region level  
3 verification step (f) comprises further exploiting domain  
4 knowledge.